

NOTICES AND DESCRIPTIONS OF FOSSILS, FROM THE MARSHALL GROUP<sup>112</sup> OF THE WESTERN STATES, WITH NOTES ON FOSSILS FROM OTHER FORMATIONS.

BY ALEXANDER WINCHELL, DIRECTOR OF THE GEOLOGICAL SURVEY OF MICHIGAN.

The following notices and descriptions were drawn up in March last, but their publication has been delayed by pressing and unremitting engagements, which continued, very unexpectedly, through the entire Summer.

These studies are based chiefly on specimens from Tennessee and Ohio. The Tennessee specimens were submitted (with others) by Prof. James M. Safford, about three years ago, and the conclusions have very recently been announced in his Report on the Geology of that State. The Ohio specimens consist of fossils communicated from time to time, during two or three years past, by Rev. Herman Herzer, and of a series of fossils collected by Prof. E. Andrews, along a section extending from the Blue Limestone, near Cincinnati, along the Ohio river to the Coal Measures,<sup>113</sup> and others collected in Central Ohio and western Pennsylvania.

In order that the references in the following pages may be made intelligible, I subjoin the section communicated by Prof. Andrews:

*Section along Ohio river from Adams to Lawrence counties, Ohio.*

COAL MEASURES.

No. 1.	{ Measures embracing beds of Iron Ore.....	207 ft.
	{ Coal, } .....	157 "
	{ Underlying measures, } .....	
No. 2.	{ Coarse-grained sandstone of Coal Measures, } .....	38 "
	{ Clays and Iron Ore, } .....	
No. 3.	{ "Sub-carboniferous Limestone" of Ky., overlying the } .....	46 "
	{ "Knobs" of the Kentucky Reports, } .....	

WAVERLY SERIES.

No. 4.	{ Sandstones containing, above, marine plants, <i>cauda-galli</i> and other fucoids, and near the bottom, nodules of Kidney Iron Ore. At the bottom is a mass of sandstone and Iron Ore embracing, probably, the fossils of Scioto-ville, Flag's Hill, &c.....	258 "
	{ Sandstones.....	114 "
No. 5.	{ Fossiliferous ferruginous sandstone of Rockville, } .....	127 "
	{ Sandstones with Fucoids, } .....	
	{ Shales containing the <i>Goniatites</i> described by Dr. Hildreth, } .....	
No. 6.	{ "City Ledge," 5 ft. above black shale.....	4 "
	{ Waverly black shale. Fish-bed, <i>Lingula subspatulata</i> , <i>Discina capax?</i> Ganoid scales, &c.....	16 "
	{ Lower Waverly beds with Fucoids.....	127 "

<sup>112</sup>For other papers by the author, on the Geology and Paleontology of this group, see "First Biennial Report" of the Geological Survey of Michigan, 1860; Amer. Jour. Sci. and Arts [2] vol. xxxiii, p. 332; ib. xxxv, p. 61; Proc. Acad. Nat. Sci., Phil., Sept., 1862, p. 465; ib. Jan., 1863, p. 2; ib. July 1865; Pro. Amer. Phil. Soc., No. 81, (vol. xi) 1869, p. 57; Geology of Tenn., 1869, pp. 364-5 and 440.

<sup>113</sup>This section was read in substance, at the Chicago meeting of the American Association, in Aug., 1868.

- No. 7. Ohio Black Shale, embracing beds of fire-clay and *septaria*, 320 “  
 No. 8. { Buff-colored limestone, arenaceous (“Cliff Limestone”)  
           { with beds of lenticular Iron Ore near the bottom.  
 No. 9. Brown and light colored clays (Dr. Locke’s “Marl”).  
 No. 10. { Middle or Flinty Limestone, underlaid by yellow clay con-  
           { taining thin layers of limestone.  
 No. 11. Blue Limestone.

The “Waverly,” of Ohio, is regarded by Prof. Andrews, as extending from the “Subcarboniferous Limestone (No. 3), to the “Ohio Black Shale” (No. 7). The Chemung and Portage may be embraced in No. 6.

No. 7 is generally regarded as the equivalent of the “Genesee Shale,” of New York.

No. 8 is found to contain the following Niagara species: *Trematopora tubulosa*, Hall; *Caryocrinus ornatus*, Say; *Retepora aspero-striata*, Hall; *Obolus imbricatus*, n. sp.;<sup>114</sup> *strophomena striata*, Hall; *S. rhomboidalis*, Wahl; *S. Niagarensis*, Win. & Mar.; *Hemipronites subplanus*, Con. sp.;<sup>115</sup> *H. hemiaster*, Win. & Mar.; *Orthis elegantula*, Dalm. sp.; *Cornulites flexuosus*, Hall;<sup>116</sup> *Spirifer sulcata*, Hising, sp; *Atrypa reticularis*, Dalm. A. *neglecta*, Hall; *A. cuneata*, Hall; *Meristella nitida*, Hall, *Pentamerus* sp?; *Platystoma Niagarensis?* Hall,<sup>117</sup> *Orthoceras* sp?; *Dalmania limulurus*, Green sp., *Calymene Niagarensis*, Hall.

No. 9 of Andrews’ section contains the following species, some of which are known to belong to the Clinton group: *Rusophycus clavatus* and *bilobatus*, Hall; *Fenestella prisca*, Hall, and *Obolus imbricatus?* n. sp.

It will be noticed that the characteristic fossils of the Waverly Group are traced to near Shafer’s, on Oil Creek, Pa., at a locality said to be “200 to 300 feet below the coal,” where we find such species as *Chonetes pulchella* Win.; *Lingula membranacea* Win.; *Hemipronites inequalis*, Hall sp.; *Syringothyris typa*, Win.; *Spirifera Carteri*, Hall; *Discina Gallaheri*, Win.; with others common to the Waverly and later formations. At Kinzua, Pa., however, which is stated to be “300 or 400 feet below the Coal Conglomerate,” we seem to have passed into the limits of another fauna. Not a single species can be recognized as belonging to the Waverly. On the contrary, *Spirifera disjuncta* (Phillips) Hall, a species of the Chemung Group, of New York, is conspicuous and well determined. Fragments of lamelliibranchs which appear to belong to the Chemung

<sup>114</sup> Shell small, nearly circular, with a slightly projecting beak in the ventral valve, false area very small and inconspicuous, central median ridge distinct but delicate, becoming broader anteriorly, and vanishing in front of the centre; a longitudinally oval scar on each side of the central ridge. Surface marked, especially in the older shells, by numerous concentric imbricating lamellae of growth. Transverse diameter 5-16 inch; length of ventral valve about the same. This is a smaller species than *O. Conradi*, Hall, with a more lamellose exterior, and, so far as I have been able to observe, a different cardinal structure.

<sup>115</sup> Several specimens, agreeing very well with the description and figures of New York specimens, but apparently *not* the same as the Illinois specimens referred to this species. (Ill. Geol. Rep III, 349).

<sup>116</sup> The single specimen has the rings somewhat constricted below, instead of regularly convex as in *C. arcuatus* Con.

<sup>117</sup> A carinated shell, more appressed laterally than the carinated varieties figured by Prof. Hall.

species *Arricula longispina* and *acanthoptera*, Hall, are also abundant, as well as a *Rhynchonella*, which differs from any known Waverly species.

It seems, therefore, from these indications, that the line separating the Chemung and Waverly, passes between these two horizons; and that we have here positive paleontological and stratigraphical evidence of the superposition of the Waverly above the Chemung, as I have heretofore argued.<sup>118</sup>

The fossils from Tennessee identified with species of the age of the Marshall (or Waverly) Group, will undoubtedly be regarded as possessing considerable interest, as this is the first paleontological determination of the extension of this group into that State. They are mostly embraced in a thin deposit of dark, silicious, bituminous shales, emitting an agreeable aromatic odor,<sup>119</sup> and resembling in physical characters, the shales of the Kinderhook Group, of Illinois. This resemblance suggests the belief that the Hickman shales of Tennessee are a prolongation of the Kinderhook shales; and that they will yet be traced along both sides of the Coal Measures, from Indiana and Illinois across the western extremity of Kentucky.<sup>120</sup>

ZAPHRENTIS *IDA?* Win. (Proc. A. Nat. Sci., Phil., July, 1865). From Hickman county, Tenn., and Sciotoville, Ohio, (See Andrews' section). The Tennessee specimens are without epitheca, and lack the profound wrinkles of growth belonging to the types of this species, from Rockford, Ind. They also enlarge upward somewhat more rapidly. The Ohio specimen is extremely similar to these.

TREMATOPORA? *VESICULOSA*, Win. (Proc. A. Nat. Sci., Phil., Jan., 1863, p. 3). Several good specimens from Sciotoville, Ohio.

<sup>118</sup> See especially Proc. Amer. Phil. Soc., No. 81, p. 57, and Proc. Acad. Nat. Sci., Phil., July, 1865, p. 110.

<sup>119</sup> See further notices of these rocks, Geology of Tenn., chap. XI, sec. I.

<sup>120</sup> Descriptions of these fossils are embraced in the late Report on Tennessee, in a paper embodying notices of some fossils from the "Carboniferous Limestone," of that State. As Prof. Safford has questioned the correctness of my identification of *Spirifer Logani*, I embrace this opportunity to state that I have reinvestigated the question and remain of the same persuasion as before, though I admit there is room for differences of opinion. I have five specimens of *S. imbrex*, (to which Prof. Safford refers the specimens in question) from the typical locality, at Burlington, Iowa. The Tennessee specimens differ from these as follows: They are larger, heavier and coarser shells; the sinns is more deeply sunk, relatively broader, and more distinctly defined, and it is greatly produced in front, while that of *S. imbrex* is scarcely at all produced; it embraces from 10 to 12 costæ, while that of *S. imbrex* embraces only 6 or 8; the fold, instead of being obsolete, and a mere undefined swell, is raised into a prominent, crest-like, acute ridge, especially toward the front; the dorsal valve is flattened from the middle of the fold to the extremities; the area is not flat, and is striated in both directions; the costæ, besides being smaller, are less numerous, except in very old specimens; they are crossed only by fine concentric striae, and remote irregular grooves. Instead of coarse, regular, imbricating striae raised into nodes on the crests of the costæ, as is the case with the surface of *S. imbrex*, when well preserved.

On the contrary, these specimens agree with *S. Logani*, especially in the following distinctive characters: "Dorsal valve depressed toward the cardinal extremities, and broadly curving to the base; mesial fold very prominent, extremely elevated and subangular in front, not defined at the margins. Ventral valve very gibbous at the sides, marked by a broad, deep, undefined mesial sinus which, in the middle of the shell, occupies fully one-third of the width, sloping abruptly to the cardinal extremities, and extremely produced and elevated in front, in a sub-triangular extension;" the area is concave, vertically and longitudinally striate.

The correct identification of these Tennessee specimens is important, as having a bearing on the question of the equivalencies of the "Silicious Group," of Safford.

LINGULA SUBSPATULATA? M. & W. (Ill. Geol. Rep. III, 437, pl. 13, fig. 1). From Tennessee, and No. 6, Rockville, Ohio. The single specimen from Tennessee, showing the inside of (apparently) the ventral valve, is not over one-third the length of the specimen figured in the Illinois Report; but it otherwise agrees with the description in outline, surface markings, position of beak and faint radiating lines along the middle.

*Lingula sub-spatulata* was described from the "Black Slate," of Union county, Ill. At Vanceburg, Ky., and other localities on both sides of the Ohio river, is a black shale embraced within the Waverly series, (see No. 6, Andrews' section) which contains a small *Lingula*, not easily distinguishable from the Tennessee specimen. If the Ohio, Kentucky, and Tennessee specimens are really identifiable with the Illinois species, it appears strange that the latter should be found in a geological position so much lower. There seems to be occasion for the query, whether the Illinois equivalent of the Vanceburg Shale has not become confounded with the "Black Shale," by the disappearance of intervening beds; and also, whether the entire mass of the "Black Shale," of southern Ohio, Indiana and Illinois, does not, in fact, belong in a position considerably above the Genesee Shale, as Verneuil, Owen and others long ago suggested.<sup>121</sup>

I am led to suspect that *L. sub-spatulata*, M. & W., is identical with my *L. membranacea*.<sup>122</sup>

LINGULA MEMBRANACEA, Win. (Proc. Acad. N. S., Phil., Jan., 1863). From near Shafer's, Penn.

DISCINA SAFFORDI, n. sp.

Shell rather small, outline nearly circular, but generally a little flattened posteriorly, and also on each of the postero-lateral boundaries. Upper valve rather depressed conical, with the beak midway between the centre and the posterior side; under surface presenting a faint but distinct linear ridge extending anteriorly from the beak one-fourth the diameter of the shell. Lower valve very depressed convex, with an apical pyriform indentation having a blunt spur projecting from its broad anterior end; no perforation visible. Exterior of both valves ornamented with numerous fine, unequal, concentric striæ; interiors smooth, except the faint vascular markings near the borders.

This curious species most resembles in general appearance, *Discina Lokensis*, from the Genesee Shale; but the pyriform indentation of the ventral valve, the finer external striæ and the inconspicuous foramen will serve to distinguish it.

From dark bituminous Shales just above the "Black Slate," of Hickman county, Tennessee.

<sup>121</sup> The "Black Shale," of northern Ohio, Ontario and Michigan, is undoubtedly the "Genesee," as is proven both stratigraphically and paleontologically. (See Proc. Amer. Phil. Soc., No. 81, p. 77, &c.)

<sup>122</sup> I take occasion to remark that *Gyroceras? Rockfordensis*, M. & W., (Ill. Rep. III, p. 459) from Rockford, Ind., is identical with my *Cyrtoceras Rockfordense*, described in Proc. Acad. Nat. Sci. July, 1865.

DISCINA CAPAX? White (Proc. Bos. Soc. Nat. Hist.) From Black Shale (Bed No. 6), Rockville, Ohio.

These specimens resemble *D. Lodensis* in size and markings. They differ in the more prominent and more excentric beak of the dorsal valve. The striæ of *D. Lodensis* are also more regular and more sharply raised, and it is a larger species. It is smaller and thinner than the types of *D. capax*, but I hesitate to pronounce it distinct.

DISCINA GALLAHERI, Win. (Proc. A. N. S., Phil., July, 1865). Collected by Prof. Andrews, at Granville, Licking county, Ohio,—adherent on a *Spirifera*; also, from near Shafer's, Penn.

The Ohio specimens differ from *D. Gallaheri* only in size—being one-half the diameter, or less. The indentation of the dorsal valve is lenticular in outline, and extends nearly from the posterior margin to the centre of the valve. Along the middle of the indentation on the inside is a ribbon-shaped impression, bounded by a sharp, elevated ridge on each side, and divided by a similar, parallel ridge running along the middle of the impression. Each portion of this impression is marked by extremely delicate, raised, transverse lines, which would seem to indicate that the impressions are not the foramen, but a portion of the shell. The foramen may have been a delicate slit occupying the place of the median ridge dividing the two impressions. In *D. Saffordi* the foramen appears to be similarly wanting, and it may have been equally slit-like during life.

The Pennsylvania specimens are mere casts of the non-perforate valve, slightly oval in outline, with irregular, concentric wrinkles, a sub-central beak elevated one-third the smaller diameter of the valve. One of the three casts bears apparently the impressions of the ribs of some costate shell, suggesting that this individual, like the Ohio specimens, may have been parasitic. The larger of these casts are fourteen-sixteenths by eleven-sixteenths of an inch in diameter.

PRODUCTA CONCENTRICA, Hall (Iowa Geol. Rep. 517, pl. vii, fig. 3; 10 Rep. N. Y. Regents, 180; see also, Winchell, Proc. A. N. S., Phil., July, 1865, p. 115). From yellowish-brown calcareo-argillaceous beds, and from calcareo-silicious shales of Tennessee. Also, from Sciotoville, Ohio.

The Tennessee collection contains one specimen showing both valves, one showing the ventral, and one both sides of the dorsal valve. Another specimen exhibiting the exterior of a ventral valve, resembles the forms named *P. Shumardianus* by Prof. Hall; but this name is probably a synonym of *P. concentrica*.

PRODUCTA SEMIRETICULATA, Fleming.

Collected by Rev. H. Herzer, at Newark, Licking county, Ohio; by Prof. E. Andrews, at Sciotoville (where it is abundant); from bed No. 5, Rockville; from a point  $2\frac{1}{2}$  miles west of "Cincinnati Furnace," Vinton county, Ohio (in the upper Waverly); and in large and characteristic specimens from near Shafer's, on Oil Creek, Venango county, Penn.

PRODUCTA COOPERENSIS? Swallow.

From bed No. 4, Sciotoville, Ohio.



There are several specimens of this form, and they differ from specimens of *P. Cooperensis* from Burlington, Iowa, principally in a much shallower ventral sinus and a larger size. In size, and in the peculiar arrangement of the granulations of the inner surface, they resemble *P. duplicostata*, Win., but the costæ are less developed, and there are fewer spines distributed over the general surface. These forms resemble, not a little, *P. viminalis*, Hall, from the Burlington Limestone, but the costæ are less pronounced, and the ventral valve enlarges less rapidly. This is possibly the species which has sometimes been referred to *P. Cora*, D'Orb.

PRODUCTA GRACILIS? Win. (Proc. Acad. N. Sci., Phil., July, 1865.) From bed No. 4, Sciotoville, Ohio.

The numerous casts from this locality do not preserve the striations as strongly as the types of this species; but they are too broad for *P. parvula*, and the ventral valve is not sufficiently produced. It is desirable yet to make comparisons with specimens of *P. minuta*, Shum.

PRODUCTA MORBILLIANA, Win. (Phil. Proc., July, 1865, p. 113.) From bed No. 4, Sciotoville, Ohio.

PRODUCTA ARCUATA, Hall (Iowa Rep. 518, pl. vii. fig. 4, a. b). Quite abundant in bed No. 5, Rockville, Ohio. Quite identical forms occur also at Granville, O.

CHONETES MULTICOSTA, Win. (Proc. A. N. S., Phil., Jan., 1863, p. 5.) In yellowish-brown calcareo-argillaceous beds and dark bituminous shales in Hickman and Maury counties, Tennessee.

There are two dorsal valves in Prof. Safford's collection. They agree with this species, except that the striæ are considerably more obscure than even in the typical specimens; and the external surface is minutely granulated.

This species ranges from the base of the Yellow Sandstones, at Burlington, Iowa, into the base of the Burlington Limestone.

CHONETES PULCHELLA, Win. (Proc. A. N. Sci., Phila., Sept., 1862.) A single ventral valve occurs among the specimens from Tennessee. It exposes only the inside, and hence the number of ribs cannot be satisfactorily ascertained. A slightly divergent spine appears at each extremity of the hinge line.

Several clearly marked specimens from Newark, Ohio, occur in Prof. Andrews' collection. These exhibit, however, three or four hollow spines each side of the beak.

Other specimens from near Shafer's, on Oil Creek, Pa., are almost perfectly identical with these.

CHONETES FISCHERI, N. & P. (Jour. A. N. S., Phil., vol. I). From dark bituminous shales, Tennessee.

CHONETES GENICULATA? White (Proc. Bos. Soc. N. Hist. IX, 29). From bed No. 5, Rockville, Ohio.

The few imperfect specimens in the collection agree with forms occurring at Burlington, Iowa, in the Yellow Sandstones, and sometimes referred with doubt to *C. geniculata*. I suspect they may all prove to be *C.*

*pulchella*, Win. The type-specimens of *C. geniculata* are from Clarksville, Mo., and, besides presenting the characteristic geniculation in the ventral valve, appear to have a rather shorter hinge line than these specimens.

CHONETES ILLINOISENSIS, Worthen (Trans. St. Louis Acad. Sci. I, 571). Occurs in bed No. 5, Rockville, Ohio.

HEMIPRONITES INEQUALIS, Hall sp. (Io. Geol. Rep. 490, pl. ii, fig. 6, a—c.) Collected by Rev. H. Herzer, at Newark, Ohio, and by Prof. Andrews, at Granville. Collected, also, by the latter in Pennsylvania, near Shafer's.

HEMIPRONITES UMBRACULUM? Schloth. (Die Petrefact. I, p. 256, and II, p. 67.)

Collected by Rev. H. Herzer, at Newark, Ohio, and by Prof. Andrews, in bed No. 4, at Sciotoville and bed No. 5, Rockville, and also, near Shafer's, Penn.

It may well be doubted whether the large specimens ranging through the equivalents of the Marshall group, in the Western States, really belong to the foreign species to which they have generally been referred.

ORTHIS SUBELLIPTICA? W. & W. (Bos. Proc. VIII, 292.) From bed No. 4, Sciotoville, Ohio. A single imperfect specimen.

ORTHIS MICHELINI? L'Évéillé.

From bed No. 5, Rockville, Ohio; from Granville, Licking county; from Vinton county; and also, from near Shafer's, Penn.

The specimens from all these localities agree with each other and with specimens commonly referred to *O. Michelini*. It is a form probably identical with that from Clarksville, Mo., referred to *O. Vanuxemi*, by Prof. Hall. The smaller, flattened specimens approximate *O. Jlava*, Win., from the Burlington Sandstone, while a large, transversely oval specimen from Rockville, approaches *O. resupinata*, except in much smaller size. In the considerable convexity of some of the dorsal valves (especially from Shafer's), and also in the cast of the muscular scars, they differ from *O. impressa*, Hall. If there are any permanent specific distinctions among the widely extended American forms commonly referred to *O. Michelini*, it will require extended and careful comparisons to make them out.

SPIRIFERA HIRTA? White & Whitfield.

The single specimen from silicious Shales, Tennessee, is considerably larger than specimens from Burlington, Iowa, the typical locality, and perhaps the area is a little more extended laterally.

SPIRIFERA EXTENUATA, Hall (Iowa Rep. 520, pl. vii, fig. 6). Collected by Rev. H. Herzer and Prof. Andrews, at Newark, O.

SPIRIFERA WAVERLYENSIS, n. sp.

Shell semi-circular, without plications (on the cast). Ventral valve with an elevated, nearly flat, transversely furrowed and vertically striated area, reaching the whole length of the hinge-line, which is scarcely less than the greatest width of the valve. The plane of the area forms a right angle with the plane of the valve. Surface more rapidly convex near the margin than between the beak and the middle; lateral slopes, also, gently convex. Sinus deep, well defined, occupying nearly one-fourth the

width of the valve, slightly produced anteriorly. Dental lamellæ extending three-fifths the length of the valve, not approximated at the rostral extremity. Muscular scars striate. Surface of cast destitute of plications, but deeply marked toward the front by wrinkles of growth.

Transverse diameter, one and five-eighths inches; antero-posterior diameter, one inch; height of area, three-eighths of an inch.

This species is more completely destitute of plications than any other in rocks of the same age; and this character, together with the length, width and flatness of the area, renders it necessary to admit it as new.

SPIRIFERA CARTERI, Hall (*S. Vernonensis*, Swallow). Very abundant in bed No. 4, Sciotoville, Ohio; rare in bed No. 5, Rockville. A single specimen labelled Granville, is, probably (judging from the matrix), from Sciotoville. Occurs also, near Shafer's, Penn.

SPIRIFERA MARIONENSIS, Shum. (Mo. Geol. Rep., Pt. ii. p. 203, pl. C., fig. 8, a—d.) Several specimens from bed No. 4, Sciotoville, Ohio. These specimens agree tolerably well with the description of this species, and with specimens from Clarksville, Mo. This seems to be a species, however, which exhibits a tendency to graduate on the one hand, into *S. biplicata*, and on the other, into *S. Carteri*. Young specimens exhibit a well defined ventral sinus, with about two incipient plications; and having, at this age, sharper dorso-lateral angles, they closely approximate *S. biplicata*. Large specimens, on the contrary, can scarcely be distinguished from *S. Carteri*, save by the less pronounced sinus and fold.

There are, indeed, six species described from rocks of this age, which need to be re-examined and compared, viz: *S. Marionensis*, Shum., 1855; *S. Carteri*, Hall, 1857-8; *S. biplicata*, Hall, 1858; *S. Vernonensis*, Swallow, 1860; *S. Osagensis*, Swal., 1860; and *S. Missouriensis*, Swal., 1860. The three first are, perhaps, distinct species—possibly all the others.

SPIRIFERA SUBROTUNDATA, Hall (Iowa Geol. Rep., p. 521). From bed No. 4, Sciotoville, Ohio.

On some of the casts no striations are certainly seen, except over a limited space one side of the beak.

SPIRIFERA BIPLICATA? Hall. A single imperfect specimen, from No. 4, Sciotoville, Ohio. See remarks above on *S. Marionensis*.

SPIRIFERINA SOLIDIROSTRIS, White (Bos. Jour. VII, 232). Collected by Rev. H. Herzer, at Newark, Ohio, and by Prof. Andrews, from bed No. 4, Sciotoville, and bed No. 5, Rockville.

SYRINGOTHYRIS TYPA, Win. (Proc. Acad. N. S., Phil.) This species occurs quite abundantly in Ohio. Mr. Herzer and Prof. Andrews have furnished over a dozen specimens from Newark. In bed No. 4, Sciotoville, it forms, with *Spirifera Carteri* and several other species, the principal mass of a highly ferruginous stratum of sandstone. It occurs freely, also, near Shafer's, in Pennsylvania.

From Newark specimens may be worked out good views of both valves, and of the bifariouly striated area. Traces of the pseudo-deltidium may also be seen, and it appears that the dental lamellæ are very deep, but the essential structure of the genus does not appear. There is one exceptional



specimen, which may be a dorsal valve distorted by pressure exerted at the hinge extremities. If undistorted, it belongs, evidently, to a distinct species.

In many of the Sciotoville specimens, the fissured tube and other details of the internal structure of the genus are distinctly shown, but there is difficulty in isolating the specimens from the mass.

A specimen in Prof. Andrews' collection from Newark, which has the beak of the ventral valve somewhat less elevated than usual, and the area considerably vaulted, presents on the cast of this valve generic (?) characters which have not before been noticed. The whole width of the broad sinus, in the middle of the valve, is occupied by a pair of very peculiar oclucisor scars, separated by the shallow impression of a low median ridge. Each scar appears somewhat like the representation of the head of a sheaf of wheat—the divergent and pendent heads of grain being turned toward the extremities of the shell. The two scars together are an inch broad, and of equal length. These characters recur in a specimen from Shafer's, Pennsylvania.

I have some suspicion that *Syringothyris typa* is identical with *Spirifera capax*, Hall. The principal distinction, so far as I observe, consists in the lobular, anterior prolongation of the ventral sinus of the former. In a specimen having a transverse diameter of  $3\frac{1}{2}$  inches, and a height of area of  $1\frac{3}{8}$  inches, the ventral sinus projects three-fourths of an inch beyond the general front of the shell. All of my specimens present this character; but it does not appear in the description and figures of *S. capax*. As this is a character which probably bears a relation to the age of the shell, it may be that *S. capax* was described from immature specimens. If so, this species should be known as *Syringothyris capax*.

SPIRIGERA HANNIBALENSIS, Swallow (St. Louis Trans. vol. I, p. 649). Several good casts from bed No. 4, Sciotoville, some of which show both valves. Impressions of the exterior are common, showing that this species flourished to luxuriant dimensions. A pair of spines is preserved, with a bit of smooth shell attached.

SPIRIGERA OHIENSIS, Win. (Proc. A. Nat. Sci., Phil., July, 1865, p. 118.) From bed No. 4, Sciotoville, Ohio.

RHYNCHONELLA SAGERIANA, Win. (Proc. Acad. N. Sci., Phil., Sept., 1862, p. 407.) Six specimens from dark bituminous shales, Tennessee. Also, from Newark, Ohio; bed No. 4, Sciotoville; Granville (abundant,) and from "Cincinnati Furnace," Vinton county, where it is of frequent occurrence.

This is a common and widely distributed species. I have heretofore known it from remote parts of Michigan, and from Medina, Ashland, Cuyahoga, Summit and Licking counties, Ohio.

RHYNCHONELLA MISSOURIENSIS, Shum. (Mo. Report II, 204.) From bed No. 4, Sciotoville, Ohio.

RHYNCHONELLA MARSHALLENSIS, Win. (Proc. A. N. S., Phil., Sept., 1862.) From Granville, Licking county, Ohio.

## CENTRONELLA? FLORA, n. sp.

Shell broadly ovate, rather rectilinear along the cardinal slopes, broadly and slightly sinuate, or not, along the ventral commissure; general form of each valve a segment of a sphere. Surface of shell very finely and sharply striate both longitudinally and concentrically.

Length, fifteen-sixteenths of an inch; breadth, fourteen-sixteenths; thickness of both valves seven-sixteenths.

This species is broader and less rostrate than *C. Allei*, Win. (Proc. A. N. S., Phil., July, 1865, p. 123,) and also less tumid around the margins, besides being much more distinctly striate.

Though I am not positive of the generic relations of this species, it appears to be congeneric with *C. Allei*. These species are both ornamented with beautiful terebrataloid punctations, and both exhibit the elongated ribbon-like muscular markings on the ventral valve which also characterize the well-determined species *C. Julia*. In one of the specimens referred (provisionally) to *C? Flora*, there is a low, but elongated median septum in the dorsal valve, from which, near the beak, proceeds, on each side, a thin horizontal, longitudinal plate, reaching half the length of the septum. In the ventral valve, the dental lamellæ are feebly developed, and, instead of reaching the inner surface of the valve, they curve toward the median line and join each other, leaving a small space between the transverse septum thus formed and the surface of the valve—being thus a kind of *shoe-lifter septum inverted*,—or, more strictly, a trough-like plate, as in *Camarophoria*, but not, like that, supported by a median vertical plate. It is worthy of consideration whether these distinctive characters are not of generic importance. The structure noticed in this specimen connects *Pentamerus* with *Terebratula*, as *Camarophoria* connects *Pentamerus* with *Rhynchonella*. I reserve the subject for further study.

From bed No. 4, Sciotoville, Ohio.

PERNOPECTEN? COOPERENSIS, Shum. sp. (Mo. Geol. Rep., Pt. ii, p. 206, pl. C, 15.) Herzer's collection, Newark, Ohio.

The single internal cast referred to this species is rather too narrow—having about the form of *P. limaformis*. It is marked by about fifteen coarse radiating grooves, with some traces of smaller intermediate ones.

Messrs. Meek and Worthen have expressed a strong suspicion (Ill. Geol. Rep. III, p. 454), that *Pernopecten limaformis* and *P? Shumardianus* are but varieties of *Avicula Cooperensis*, Shum. I embrace the opportunity to correct the impression of these authors that the surface characters of *P. limaformis* have not been seen in a perfect state of preservation. I have impressions of exteriors of this species upon fine (almost lithographic) stone, in which the most delicate characters are much more perfectly preserved than they generally are in fossils retaining the actual shell. Gutta percha restorations from these moulds are perfectly destitute of fine radiating striæ. On the contrary, they exhibit very fine, sharp and regular concentric striæ, and obsolete traces of a few straggling, irregular, discontinuous, broad folds or undulations. This species is also distinctly narrower than the others. With little doubt, its validity should be admitted.

PERNOPECTEN LIMATUS? Win. (Proc. A. N. S., P., July, 1865, p. 126.) Newark, and bed No. 4, Sciotoville, Ohio.

Like the other Ohio representatives of the species of this family, the specimens of this species are considerably larger than the Iowa types.

AVICULOPECTEN NEWARKENSIS, n. sp.

Dorso-ventral and antero-posterior diameters and length of hinge line as the numbers, 14, 10 and 7. Left valve rather convex, its cardinal slopes forming an angle of about  $60^{\circ}$ , and thus creating a sharper beak than is usual in this genus. Anterior ear somewhat inflated, with about six strong radiating striæ, finer intermediate ones, and numerous fine decussating striæ. Posterior ear a little smaller, flat, its posterior boundary nearly at right angles with the hinge. Beak scarcely exceeding the hinge. Surface marked with numerous fine, unequal, slightly wavy, delicately crenulated, radial striæ.

Dorso-ventral diameter fourteen-sixteenths of an inch; antero-posterior, ten-sixteenths; length of hinge line, seven-sixteenths.

The striæ are of the size of those in *A. tenuicostus*, Win., but they are less rigid, regular and uniform; the shell is less circular, and the umbo is more prominent.

AVICULOPECTEN CAROLI, Win. (Proc. A. N. S., Phil., Jan., 1863, p. 9.) From Newark, bed No. 4, Sciotoville, and from Granville, Ohio.

The specimens from Licking county are all right valves, and are much flatter than typical specimens of the same valve.

AVICULOPECTEN OCCIDENTALIS, Win. (Proc. A. N. S., Phil., Jan., 1863, p. 9.) From Newark, Licking county, Ohio. The largest specimen is twice the size of the Iowa types. A right valve of the same size, from Granville, shows also obsolete, irregular, radiating furrows around the margin of the cast.

SANQUINOLITES NAIADIFORMIS, n. sp.

Length two and a half times the height; laterally flattened below the umbo; dorsal and ventral margins parallel or nearly so—the ventral sometimes with a broad shallow sinus extending upwards over the valves and vanishing near the umbo; a distinct umbonal ridge flattening out near the postero-ventral angle, at which place the outline presents a rounded angulation; the postero-dorsal slope making, with the dorsum, an angle of  $45^{\circ}$ .

Length,  $2\frac{3}{4}$  inches; height, one and one-sixteenth inches; thickness, half an inch.

The above description is based on a specimen from Hillsdale, Michigan. Mr. Herzer has sent a single specimen from Newark, Ohio, which agrees with this; but such is the state of preservation of lamellibranchs in this formation, that there is extreme difficulty in ascertaining their generic characters. Another specimen from Granville, Ohio, presents a still better specific accordance.

SANQUINOLITES (CYPRICARDIA?) SECURIS, n. sp.

Outline of shell sub-oval, anteriorly indented by a small lunule, over which hangs the small, incurved, approximated, sub-terminal beaks. A very prominent, sub-acute ridge runs from the beaks posteriorly and but

little below the level of the straight indented hinge line. The greatest thickness of the shell is therefore near the flattened dorsal border. From this ridge the lateral surfaces proceed with slight curvature to the ventral margin, so that the united valves present a cuneate or somewhat axe-like form.

Length, one inch ; height, thirteen-sixteenths ; transverse diameter, nine-sixteenths.

This species is less elongate than *Cypricardia rigida*, and has a rounded, instead of truncate posterior extremity ; the umbonal ridge, also, is nearer the hinge margin.

Collected by Rev. H. Herzer, at Newark, Ohio.

SANGUINOLITES MARSHALLENSIS, Win.

Occurs in bed No. 4, Sciotoville, Ohio.

ALLORISMA (SEDGWICKIA) HANNIBALENSIS, Shum. (Mo. Rep. p. 206). Specimens from Newark, Ohio, agree better with the Burlington (Iowa) forms usually referred to this species, than with Dr. Shumard's figure of the type.

CYPRICARDIA (?) RIGIDA, W. & W. (Bos. Proc. VIII, 300.)

A single specimen from Newark, Ohio, which does not show the "second ridge" between the main umbonal angle and the hinge, and which may result from dorso-ventral compression.

LEDA BELLISTRIATA? Stephens (Am. Jour. Sci. [2] vol. XXV, p. 26.) Five specimens from dark, bituminous Shales, Tennessee, are referred to this species solely on account of external resemblances. They have the peculiar form and sharp concentric furrows of the species. They are a little over an inch in length, but do not, in this, exceed specimens from Battle Creek, Michigan,—the typical locality. At the same time, no indication of hinge-structure has been observed, and the shell seems to have been thinner than usual for the species of this family. Should further discovery demonstrate that these specimens do not belong to *Leda*, they will perhaps fall into the genus *Sedgwickia* of McCoy ; but I do not consider it allowable to propose a specific name to be based on discoveries of some future investigator.

CONOCARDIUM PULCHELLUM, White & Whit. (Proc. Bos. Soc. N. H. VIII, 299.) From Newark, Ohio.

SOLENS SCALPRIFORMIS, Win. (Proc. Acad. N. S., Phil. Sep., 1862, p. 42?.) From dark, bituminous shales, Tennessee. Like other species in the same situation, the shell is thin and fragile. This probably resulted from an insufficiency of calcareous matter in the waters which precipitated the argillo-bituminous materials of the rock.

SOLENS QUADRANGULARIS, Win. (Proc. A. N. S., Phil. Jan., 1862.) A fragment from Granville, Ohio.

PLATYCERAS HERZERI, n. sp.

Shell rather large, consisting of about two coils, which enlarge rapidly near the apex, and gradually through the last half of the whorl ; laterally compressed, and dorsally sub-angulated, except near the aperture ; irregularly plicated longitudinally, and marked transversely by deeply waved,

lamellar striæ of growth indicating a coarsely and unequally crenate aperture.

Of this species two varieties may be recognized: (A) The typical form, differing from *P. paratum*, W. & W., in its excentric apex; (B) A form less profoundly plicated—perhaps because younger specimens. These forms I was at first inclined to regard as varieties of *P. haliotoides*, M. & W., but I believe the departures are too extreme and the mutually-concurring specimens too numerous for specific identity with the Illinois forms.

The largest specimens, when resting on the aperture, are an inch in height; the transverse diameter of the aperture is five-sixteenths of an inch, and the dorso-ventral diameter six-sixteenths.

Quite abundant at Newark, Ohio.

PLATYCERAS HALIOTOIDES, M. & W. (Ill. Geol. Rep. 458, pl. xiv, fig. 3). From Newark, Ohio.

PLEUROTOMARIA HICKMANENSIS, Win. (Tenn. Geol. Rep.).

Globose shells in an incomplete state of preservation, showing regularly convex whorls ornamented with numerous delicately raised and finely beaded revolving striæ, and a well-defined band, without distinct carina. The striæ limiting the band are not beaded, but all the others, on both sides, bear 50 to 60 granulations to the inch. The striæ are quite unequal in number and distribution, since they increase by implantation, with the growth of the shell. The base of the shell is about an inch in diameter, and seems to be perforated by a small umbilicus.

From dark, bituminous shales, Hickman county, Tennessee.

PLEUROTOMARIA VADOSA, Hall (XIII. Rep. N. Y. Regents, p. 108.) Numerous casts occur in bed No. 4, Sciotoville, Ohio, which are quite identical with casts from Michigan. Some imperfect moulds, larger than the typical forms, occur also in bed No. 5, Rockville, Ohio.

MURCHISONIA PROLIXA, W. & W. (Proc. Bos. Soc. N. H. VIII, 303.) Bed No. 4, Sciotoville, Ohio.

MURCHISONIA QUADRICINCTA, Win. (Proc. Acad. N. S., Phil. Jan. 1863, p. 19.) Bed No. 4, Sciotoville, Ohio.

BELLEROPHON CYRTOLITES, Hall. (XIII. Rep. N. Y. Reg.)

A single imperfect specimen from Granville, Ohio.

CONULARIA BYBLIS, White. (Proc. Bos. Soc. N. H., Feb. 1862, p. 22.) From dark, bituminous shales, Hickman county, Tennessee.

I feel no doubt of the identity of this species. It possesses the same small isolated eminences or granulations ranged in a line along the crests of the ridges, which characterize well preserved specimens from Burlington, Iowa. From 60 to 75 of these eminences may be counted in the space of an inch.

Dr. White does not mention these granulations; only stating, "spaces between the ridges finely crenulate." Worn specimens develop a series of transverse bars between the ridges, which undoubtedly correspond in position with the granulations seen in unworn specimens. Compare with this species, *C. Gervillei* d'Archiac et Vern., Mem. Foss. Rhenish Prov. in Trans. Geol. Soc., Lond., vol. VI, p. 351.



CONULARIA NEWBERRYI, Win. (Proc. A. N. S., Phil. July, 1865, p. 130.) From bed No. 4, Sciotoville, Ohio.

This shell was probably as large as *C. byblis*. It has the form of a quadrangular pyramid compressed in the direction of two opposite angles. It differs from *C. byblis* as follows:—Its form is much more distinctly angulated; the septa range from 17 to 44 to the inch, while in *C. byblis* they range from 56 to 128 to the inch; it bears a deep V-shaped furrow along each of the angles; within this furrow the septa are deflected abruptly toward the base of the shell, so that they meet from opposite sides at about a right angle; the septa also sweep toward the base with a gentle curve in their extension across the side of the pyramid, by which their centres are about two intervals lower than the portions in the ridge which bounds the angle-furrow. In *C. byblis* the septa-margins also trend toward the base, but they are more nearly straight from angle to centre. The septa, like those in *C. byblis* and many other species, are ornamented along their margins by delicate granulations. The species appears to have been at least three or four inches in length.

The septa toward the upper end become more direct, and I have little doubt that it was the apical portion of this species from which *C. Newberryi* was originally described.

ORTHO CERAS INDIANENSE, Hall. (XIII. Rep. N. Y. Reg.) From Newark and from bed No. 4, Sciotoville, Ohio. One of the specimens from the latter locality exhibits a broad constriction near the base of the outer chamber. From Newark are also fragments of an *Orthoceras* having an elliptic section and oblique septa.

NAUTILUS (TREMATODISCUS) TRISULCATUS, M. & W. (Proc. A. N. S., Phil., 1860, p. 470.) From bed No. 5, Rockville, Ohio.

GONIATITES MARSHALLENSIS, Win.

From Newark, Ohio. Differs from *G. Lyoni*, M. & W. (= *G. Hyas*, Hall), in having the transverse section regularly curved instead of broadest near the umbilicus; in having the first and second lateral lobes rounded instead of acuminate; in having an additional accessory lobe and saddle, and in having the dorsal lobe broader and relatively longer.

GONIATITES SHUMARDIANUS, Win. (Am. Jour. Sci. [2] XXXIII, 364, May, 1862.) From Newark, Ohio.

The specimens of this species, though fragmentary, exhibit nearly all the specific characters.

To the description of *G. Shumardianus* originally given, may be added the following characters, drawn from the Newark specimens: Accessory lobe concealed, same form as the lateral one, but only one-third its size, separated by a parallel-sided, circularly terminated saddle from a narrow, elongated, parallel-sided ventral lobe.

As the three species, *G. Allei*, *Shumardianus* and *propinquus*, are closely related in general aspect, their diagnostic characters may be here given in stronger contrast.

*G. Allei* wants the dorsal lobe—unless we regard the two first-lateral together with the dorsal saddle, as a bifid dorsal lobe—and has a closed umbilicus.

*G. Shumardianus* has a simple dorsal lobe and an open umbilicus.

*G. propinquus* has a shorter and narrower dorsal lobe than *G. Shumardianus*, with a closed umbilicus.

GONIATITES OHIENSIS, n. sp.

Compressed-globoid, deeply and broadly umbilicate. Dorsum rounded, sides considerably and somewhat obliquely flattened, so as to give the widest transverse section near the borders of the umbilicus, this diameter being to the dorso-ventral as 4 to 3. Dorsal lobe oblong, parallel-sided, obtuse, separated, by a broader and longer, obtusely rounded dorsal saddle, from a subclavate, acute lateral lobe, which reaches half its length behind the dorsal one. This lobe is followed by a very broad shallow saddle having its apex turned obliquely toward the dorsum. Second lateral lobe small, equilaterally triangular, situated on the brink of the umbilicus.

Greatest transverse diameter, fifteen-sixteenths of an inch; dorso-ventral diameter, twelve-sixteenths; diameter of umbilicus, seven-sixteenths.

Differs from *G. Shumardianus* in its parallel-sided, obtuse dorsal, and linguiform, acuminate first lateral lobe; also, in the oblique position of the lateral saddle. There is no species likely to be confounded with it unless it be *G. Andrewsii*, which has the sides more convex, and differs also in its acuminate-clavate dorsal lobe.

From Newark, Ohio. Collected by Rev. H. Herzer.

GONIATITES ANDREWSII, n. sp.

Compressed-globoid; deeply, broadly and abruptly umbilicate. Rounded on the sides, and more rapidly on the dorsum; greatest width close to the umbilicus; transverse diameter to the dorso-ventral as 4 to 3. Dorsal lobe long, clavate, acuminate, separated by a sub-clavate broadly rounded saddle from the first lateral lobe, which is also clavate-acuminate, but a little broader than the dorsal, and a trifle shorter. This is followed by a very broad, obliquely situated saddle, having its dorsal side concave in the middle, and its umbilical side gently convex. The whorls are marked each by about four constrictions. In one specimen, which seems to preserve a portion of the shell, it is seen to present somewhat uniform, closely-set, transverse wrinkles in the region near the umbilicus. Casts of the umbilicus retain the impression of every whorl to the very apex, and show that this species attained seven or eight volutions, the later of which increased in transverse diameter more rapidly than the earlier.

From Newark, Ohio. Collected by Rev. H. Herzer.

CYTHERE CRASSIMARGINATA, Win. (Proc. A. N. S., Phil., Sep., 1862.) From bed No. 5, Rockville, Ohio. Some of the specimens attain twice the dimensions of the types of the species.

PHILLIPSIA MISSOURIENSIS, Shum. sp.

From Newark, Ohio. Collected by Rev. H. Herzer.

All the known characters of the species are exhibited, except the granulations of the surface, which the state of preservation of the specimens renders it impossible to detect.

PHILLIPSIA TENNESSEENSIS, Win. (Tenn. Geol. Rep. p. 445.)

Glabella prominent, indented by a small, round, depressed, postero-lateral lobe, and isolated by a deep occipital furrow from a prominent

occipital ring, which extends, narrowing in width and curving backwards, entirely across the border, fading out toward the short, acute genal angle. Border concave, bounded by a prominent ridge, outside of which is a linear groove limited peripherally by a sharply elevated, delicate, linear margin. Surface of glabella, accessory lobe and neck-ring covered with fine unequal granulations; a row of granules along the ridge of the border.

Pygidium broadly rounded, nearly twice as broad as long, apparently depressed; axis with 8 or 9 rings, tapering to the posterior end, which is somewhat abruptly rounded off one-tenth of an inch from the extremity of the pygidium; lateral lobes with 8 or 9 segments becoming obscure posteriorly. Border about one-sixteenth of an inch broad, marked on the under side by nine rigid, sharply impressed parallel striæ. Exterior of the crest very finely and obscurely granulated. Length, about three-eighths of an inch; breadth, five-eighths.

Other characters of this species are unknown. It seems to approach nearest to *P. articulata*, Hall sp. (XV. Rep. N. Y. Regents, p. 107.) From the Waverly of Ohio; but is destitute of the anterior and middle furrows of the glabella. Neither does the description of that species give the surface characters, though comparison is made with *Proetus Missouriensis*, Shum., from the lithographic limestone of Missouri, which is a granulated species. It differs from *Proetus (Phillipsia) ellipticus*, M. & W. (Ill. Geol. Rep. III, 460), from the Kinderhook group, in the characters of the cephalic border, in the absence of glabellar furrows, and in the border of the pygidium.

From calcareo-argillaceous beds, of yellowish brown color, and from calcareo silicious shales, Hickman and Maury counties, Tennessee.

PHILLIPSIA DORIS, Hall sp. (XIII. Rep. N. Y. Regents, p. 112, and Winchell, Phil. Proc., July, 1865, p. 133.)

Several small pygidia occur in the collection from bed No. 5, Rockville, Ohio.

#### PLEURODICTYUM PROBLEMATICUM, Goldf.

Well preserved specimens occur at Newark, Ohio. Collected by Rev. H. Herzer.

#### MURCHISONIA sp?

A fragment nearly three inches long, consisting of four whorls—probably about one or two whorls wanting at the apex and an unknown portion from the other end. The whorls are very oblique, the deeply impressed suture making an angle of  $40^\circ$  or  $45^\circ$  with the axis of the shell. The apical angle of the spire was not more than  $18^\circ$  to  $25^\circ$ . It most nearly resembles *M. quadricincta*, Win., but it has quite a different expression, besides being much larger and having more oblique whorls.

From near Shafer's, Pennsylvania.

From Newark is a *Sigillaria*, and a *Myalina* too imperfect for identification. Two or three species of *Fenestellida* occur at Sciotoville, Rockville, and in Licking county. Three species of crinoidal stems exist in Prof. Andrews' collection, from Newark, Granville and Sciotoville. A *Sanguinolaria* occurs at Sciotoville; and at Granville and Sciotoville is an interesting compound coral with minute tubes, whose specific details are well exhibited, though its generic position is undetermined.